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Abstract

A total of 240 weanling pigs (PIC 327 Ã— 1050, initially 16.1 lb, 3 d postweaning) were used in a 28-d trial to evaluate the effects of benzoic acid and antibiotics on growth performance. Treatments were arranged as a 2 Ã— 2 factorial (with or without 0.5% Vevovitall, a source of benzoic acid; DSM Nutritional Products, Parsippany, NJ), and with or without carbadox (Mecadox; Philbro Animal Health Corp., Ridgefield Park, NJ). The 4 dietary treatments included a control (1) without Mecadox or Vivovitall, (2) without Mecadox and with Vevovitall, (3) with Mecadox and without Vevovitall, and (4) with Mecadox and Vevovitall. No interactions ($P > 0.57$) were observed between Mecadox and Vevovitall on growth performance. From d 0 to 14, there were no differences ($P > 0.12$) in ADG or ADFI between pigs fed diets with or without Mecadox, but pigs fed Mecadox tended to have poorer ($P < 0.07$) F/G than pigs fed diets without Mecadox. From d 14 to 28, pigs fed Mecadox had improved ($P < 0.01$) ADG, ADFI, and F/G compared with pigs fed diets without Mecadox. Overall (d 0 to 28), pigs fed Mecadox had increased ($P < 0.02$) ADG and ADFI. For the main effect of Vevovitall, there were no differences ($P > 0.11$) in ADG, ADFI, or F/G during either phase or for the overall data. In conclusion, feeding Mecadox increased ADG and ADFI, but no improvements in growth were found when benzoic acid was included in the diets.; Swine Day, Manhattan, KS, November 21, 2013

Keywords

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Evaluation of Antibiotics and Benzoic Acid on Growth Performance of Nursery Pigs[1]

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Summary

A total of 240 weanling pigs (PIC 327 × 1050, initially 16.1 lb, 3 d postweaning) were used in a 28-d trial to evaluate the effects of benzoic acid and antibiotics on growth performance. Treatments were arranged as a 2 × 2 factorial (with or without 0.5% Vevovitall, a source of benzoic acid; DSM Nutritional Products, Parsippany, NJ), and with or without carbadox (Mecadox; Philbro Animal Health Corp., Ridgefield Park, NJ). The 4 dietary treatments included a control (1) without Mecadox or Vivovitall, (2) without Mecadox and with Vevovitall, (3) with Mecadox and without Vevovitall, and (4) with Mecadox and Vevovitall. No interactions ($P > 0.57$) were observed between Mecadox and Vevovitall on growth performance. From d 0 to 14, there were no differences ($P > 0.12$) in ADG or ADFI between pigs fed diets with or without Mecadox, but pigs fed Mecadox tended to have poorer ($P < 0.07$) F/G than pigs fed diets without Mecadox. From d 14 to 28, pigs fed Mecadox had improved ($P < 0.01$) ADG, ADFI, and F/G compared with pigs fed diets without Mecadox. Overall (d 0 to 28), pigs fed Mecadox had increased ($P < 0.02$) ADG and ADFI. For the main effect of Vevovitall, there were no differences ($P > 0.11$) in ADG, ADFI, or F/G during either phase or for the overall data. In conclusion, feeding Mecadox increased ADG and ADFI, but no improvements in growth were found when benzoic acid was included in the diets.

Key words: benzoic acid, carbadox, nursery pig

Introduction

Vevovitall, a source of benzoic acid, has been included in European swine diets and may become available for use in the North American swine industry. This experiment is the second in a series of trials that were conducted at K-State to evaluate Vevovitall in nursery pig diets. In the previous experiment, the effect of Vevovitall in simple and complex diets was tested. Although no significant improvements in growth were observed when Vevovitall was fed, the response was not influenced by diet complexity; therefore, complex diets, which are more representative of a typical diet fed in the U.S., were used in the current experiment to further test the effects of Vevovitall.

Weaning and early nursery phases are often associated with higher stress, particularly with regards to intestinal health and development. Antibiotics are most commonly fed during this time in an attempt to lessen any negative effects on growth, but acidifiers also have been investigated as beneficial feed additives due to the potential for antibiotic-

[1] Appreciation is expressed to DSM Nutritional Products (Parsippany, NJ), for providing the Vevovitall used in diet formulation and partial financial support.
[2] Department of Diagnostic Medicine/Pathobiology, College of Veterinary Medicine, Kansas State University.
[3] DSM Nutritional Products (Parsippany, NJ).

like effects. The objective of the current experiment was to determine the effect of antibiotics on the response to Vevovitall in nursery pig diets.

Procedures

The Kansas State University Institutional Animal Care and Use Committee approved the protocol used in this experiment. The study was conducted at the K-State Swine Teaching and Research Center in Manhattan, KS.

A total of 240 weanling pigs (PIC 327 × 1050, initially 16.1 lb, 3 d postweaning) were used in a 28-d trial. Pigs were weaned at approximately 21 d of age and allotted to pens by initial BW to achieve the same average pen weight. Pigs were fed a common pelleted transition diet for 3 d. On d 3 postweaning, pens were allotted to 1 of 4 dietary treatments, arranged as a 2 × 2 factorial. Thus, d 3 after weaning was d 0 of the experiment. There were 7 pigs per pen and 7 pens per treatment. Each pen contained a 4-hole, dry self-feeder and a nipple waterer to provide ad libitum access to feed and water. Pigs and feeders were weighed on d 0, 7, 14, 21, and 28 to calculate ADG, ADFI, and F/G.

A 2-phase diet series was used. All diets were corn-soybean meal–based. From d 0 to 14, all diets contained 10% dried whey, 1.25% select menhaden fish meal, 1.25% spray-dried blood cells, and 2,000 ppm of Zn from zinc oxide (Table 1). From d 14 to 28, no specialty protein sources or additional zinc oxide were included in any diets. There were 4 dietary treatments, including a control (1) without Mecadox or Vivovitall, (2) without Mecadox and with Vevovitall, (3) with Mecadox and without Vevovitall, (4) with Mecadox and Vevovitall. For treatments 3 and 4, Mecadox was included at 50 g/ton from d 0 to 14 and 25 g/ton from d 14 to 28. Vevovitall was included in treatments 2 and 4 at 0.5%

Experimental data were analyzed as a completely randomized design using the MIXED procedure of SAS (SAS Institute, Inc., Cary, NC) with pen as the experimental unit. Treatments were arranged as a 2 × 2 factorial (with or without Mecadox and with or without Vevovitall). Differences between treatments were determined using the PDIFF statement in SAS. Significant differences were declared at $P < 0.05$ and trends at $P < 0.10$.

Results and Discussion

No interactions ($P > 0.57$) were observed among pigs fed Mecadox and Vevovitall on growth performance (Table 2).

From d 0 to 14, there were no differences ($P > 0.12$) in ADG and ADFI between pigs fed diets with or without Mecadox, but pigs fed Mecadox tended to have poorer ($P < 0.07$) F/G than those fed diets without Mecadox (Table 3). The inclusion of dietary Vevovitall had no effect ($P > 0.33$) on ADG, ADFI, or F/G from d 0 to 14.

Although the addition of Mecadox in Phase 1 had little effect on growth, from d 14 to 28, pigs fed Mecadox had improved ($P < 0.01$) ADG, ADFI, and F/G compared with pigs fed diets without Mecadox. Similar to the previous period, feeding Vevovitall from d 14 to 28 did not affect ($P > 0.11$) ADG, ADFI, or F/G.

For the overall trial (d 0 to 28), the inclusion of Mecadox increased ($P < 0.02$) ADG and ADFI but did not influence ($P > 0.21$) F/G. Consistent with the previous periods, no differences ($P > 0.14$) were observed in ADG, ADFI, or F/G when Vevovitall was fed for the overall experiment.

In conclusion, no interactive effects of feeding Mecadox and Vevovitall to nursery pigs were observed. The inclusion of Mecadox alone improved ADG, ADFI, and F/G, which was driven primarily by improvements observed in pigs from d 14 to 28 of the trial (25 to 45 lb). Feeding acidifiers has resulted in improved growth performance in several trials, but the current experiment showed only numerical improvements in growth.

Table 1. Phase 1 diet composition (as-fed basis)[1,2]

	Phase 1	Phase 2
Item	Negative control[3]	Negative control[4]
Ingredient, %		
Corn	59.93	64.50
Soybean meal (46.5% CP)	26.39	32.15
Select menhaden fish meal	1.25	---
Spray-dried blood cells	1.25	---
Spray-dried whey	10.0	---
Monocalcium phosphate (21% P)	0.85	1.05
Limestone	0.80	1.00
Salt	0.30	0.35
Zinc oxide	0.25	---
Trace mineral premix	0.15	0.15
Vitamin premix	0.25	0.25
L-lysine HCl	0.295	0.325
DL-methionine	0.140	0.100
L-threonine	0.125	0.110
Phytase[5]	0.019	0.019
Diatomacious earth[6]	1.00	---
Total	100.00	100.00

continued

Table 1. Phase 1 diet composition (as-fed basis)[1,2]

	Phase 1	Phase 2
Item	Negative control[3]	Negative control[4]
Calculated analysis		
Standardized ileal digestible amino acids (SID), %		
Lysine	1.30	1.26
Isoleucine:lysine	56	62
Leucine:lysine	129	130
Methionine:lysine	33	31
Met & Cys:lysine	56	56
Threonine:lysine	62	62
Tryptophan:lysine	17.0	17.5
Valine:lysine	69	68
Total lysine, %	1.43	1.39
ME, kcal/lb	1,480	1,504
SID lysine:ME, g/Mcal	3.99	3.80
CP, %	20.7	20.9
Ca, %	0.71	0.70
P, %	0.63	0.63
Available P, %	0.47	0.47

[1] A total of 240 weanling pigs (PIC 327 × 1050) were used in a 28-d trial to evaluate the effects of benzoic acid and antibiotics on growth performance.
[2] Vevovitall was used as the source of benzoic acid (DSM Nutritional Products, Parsippany, NJ). Mecadox 2.5 was used as the source of antibiotic (Philbro Animal Health Corp., Ridgefield Park, NJ).
[3] Pigs were fed Phase 1 diets from d 0 to 14. Diets contained 0 or 0.5% Vevovitall and 0 or 50 g/ton of Mecadox.
[4] Pigs were fed Phase 2 diets from d 14 to 28. Diets contained 0 or 0.5% Vevovitall and 0 or 25 g/ton of Mecadox.
[5] Ronozyme CT (10,000) (International Nutrition, Omaha, NE) provided 840 phytase units (FTU)/lb, with a release of 0.10% available P.
[6] Indigestible marker (Perma-Guard, Inc., Corrales, NM).

Table 2. Effect of benzoic acid and antibiotics on growth performance of nursery pigs[1]

Benzoic acid:[2]	---	Vevovitall	---	Vevovitall		Probability, $P <$		
Antibiotic:[3]	---	---	Mecadox	Mecadox	SEM	Benzoic acid × antibiotic	Benzoic acid	Antibiotic
d 0 to 14								
ADG, lb	0.64	0.65	0.64	0.67	0.026	0.61	0.33	0.57
ADFI, lb	0.87	0.88	0.91	0.95	0.033	0.60	0.51	0.12
F/G	1.38	1.36	1.42	1.41	0.026	0.95	0.46	0.07
d 14 to 28								
ADG, lb	1.20	1.24	1.31	1.36	0.026	0.79	0.11	0.001
ADFI, lb	1.87	1.91	1.97	2.01	0.037	0.99	0.23	0.01
F/G	1.56	1.55	1.51	1.49	0.018	0.75	0.32	0.003
d 0 to 28								
ADG, lb	0.92	0.94	0.97	1.01	0.022	0.72	0.14	0.01
ADFI, lb	1.37	1.39	1.44	1.48	0.032	0.86	0.32	0.02
F/G	1.50	1.48	1.48	1.46	0.016	0.76	0.28	0.21
Weight, lb								
d 0	16.1	16.1	16.1	16.1	0.153	0.96	0.98	0.96
d 14	25.0	25.2	25.0	25.6	0.447	0.67	0.43	0.63
d 28	41.9	42.5	43.3	44.7	0.748	0.57	0.20	0.02

[1]A total of 240 weanling pigs (PIC 327 × 1050, initially 16.1 lb) were used in a 28-d trial to evaluate the effects of benzoic acid and antibiotics on growth performance. There were 6 pigs per pen and 10 pens per treatment.

[2] Vevovitall (DSM Nutritional Products, Parsippany, NJ) was included in from d 0 to 14 and d 14 to 28 at 0.5% of the diet.

[3] Mecadox (Philbro Animal Health Corp., Ridgefield Park, NJ) was added at 50 g/ton from d 0 to 14 and 25 g/ton from d 14 to 28.

Table 3. Main effect of Mecadox and Vevovitall on growth performance of nursery pigs[1]

	Antibiotic[2]			Benzoic acid[3]			Probability, $P <$	
	None	Mecadox	SEM	None	Vevovitall	SEM	Antibiotic	Benzoic acid
d 0 to 14								
ADG, lb	0.64	0.66	0.018	0.64	0.66	0.018	0.57	0.33
ADFI, lb	0.87	0.93	0.024	0.89	0.91	0.024	0.12	0.51
F/G	1.37	1.42	0.018	1.40	1.38	0.018	0.07	0.46
d 14 to 28								
ADG, lb	1.22	1.33	0.019	1.25	1.30	0.019	0.001	0.11
ADFI, lb	1.89	1.99	0.026	1.92	1.96	0.026	0.01	0.23
F/G	1.56	1.50	0.013	1.54	1.52	0.013	0.003	0.32
d 0 to 28								
ADG, lb	0.93	0.99	0.016	0.94	0.98	0.016	0.01	0.14
ADFI, lb	1.38	1.46	0.023	1.40	1.44	0.023	0.02	0.32
F/G	1.49	1.47	0.011	1.49	1.47	0.011	0.21	0.28
Weight, lb								
d 0	16.1	16.1	0.109	16.1	16.1	0.109	0.96	0.98
d 14	25.1	25.3	0.316	25.0	25.4	0.316	0.63	0.43
d 28	42.2	44.0	0.529	42.6	43.6	0.529	0.02	0.20

[1]A total of 240 weanling pigs (PIC 327 × 1050, initially 16.1 lb) were used in a 28-d trial to evaluate the effects of benzoic acid and antibiotics on growth performance. There were 6 pigs per pen and 10 pens per treatment.
[2]Pigs were fed diets without or with Mecadox (Philbro Animal Health Corp., Ridgefield Park, NJ) from d 0 to 28.
[3]Pigs were fed diets without or with 0.5% Vevovitall (DSM Nutritional Products, Parsippany, NJ) from d 0 to 28.